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Fish Passages in International Hydropower Projects: Challenges and Opportunities

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FISH PASSAGES IN INTERNATIONAL HYDROPOWER PROJECTS: CHALLENGES AND OPPORTUNITIES



IFC

**International
Finance Corporation**
WORLD BANK GROUP

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Environment, Social and
Governance Department

In partnership with:

**Australian
Aid**



June 19, 2017

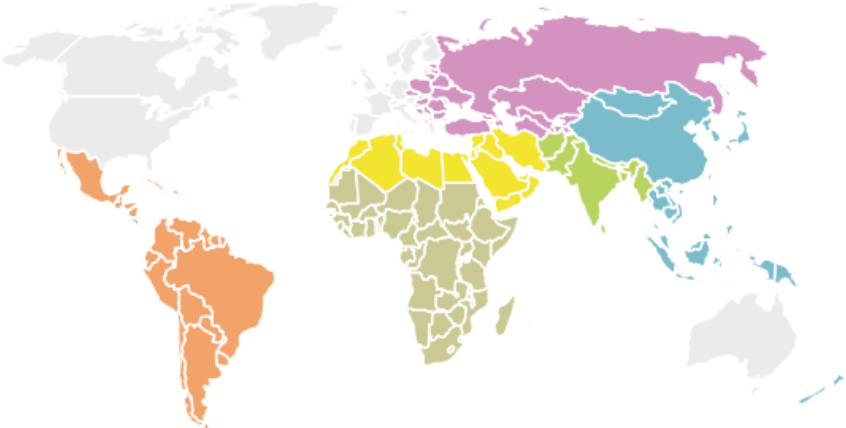
IFC (World Bank Group)

The International Finance Corporation (IFC) is the largest global development institution focused exclusively on the private sector in developing countries.

IFC Projects

<https://disclosures.ifc.org>

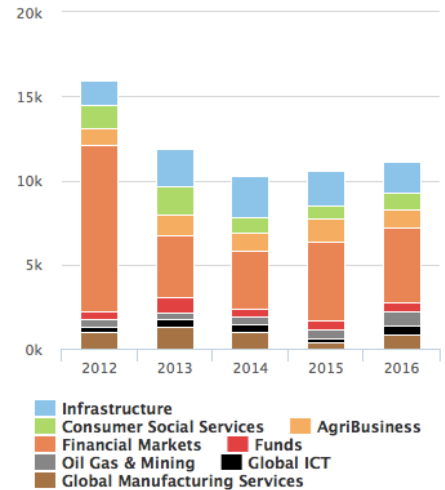
IFC Project Mapping



5638 Projects Disclosed Since 1994

Latin America and the Caribbean	1177	Europe and Central Asia	1176
Sub-Saharan Africa	1106	East Asia and the Pacific	799
South Asia	609	Middle East and North Africa	542
World	229		

Long-Term Commitments by Industry



Note: Dollars in millions, for the year ended June 30. 2012 figures include short-term finance investments.

IFC Services

IFC supports many Hydropower projects around the world through **Investments** and **Advisory Services**.

National regulatory frameworks are weak or lacking in many developing countries.

Funding recipients (IFC clients) must comply with IFC's Environmental and Social Performance Standards.

IFC's Performance Standards

PS1: Assessment and Management of Environmental and Social Risks and Impacts

PS2: Labor and Working Conditions

PS3: Resource Efficiency and Pollution Prevention

PS4: Community Health, Safety and Security

PS5: Land Acquisition and Involuntary Resettlements

PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

PS7: Indigenous Peoples

PS8: Cultural Heritage

In Natural Habitat (per PS6 criteria), projects must demonstrate

No Net Loss of Biodiversity

In Critical Habitat, projects must demonstrate

Net Gain for Critical Habitat Biodiversity Values

Customized services to **hydropower companies**:

- Assess cumulative impacts and managing river basins
- Support the development of practical E&S management systems
- Hydropower Developers' Working Groups

IFC tailors advice to **lending banks**:

- Provide diagnostic tools and environmental and social guidelines to help lower risk when lending to hydropower companies
- Support banks in making sustainable investments that yield benefits for the local people, the environment, and investors

IFC works with **environment and energy ministries**:

- Develop policies and regulations for the hydropower sector
- Strengthen technical guidelines and key water and hydropower-related laws, policies and regulations

In partnership with:



IFC Hydropower Investments

Selected IFC Hydropower Projects in Eurasia

Georgia

*HPPs with fish ladder

- Paravani* HPP, 85 MW, 5 m high weir
- Shuakhevi* HPP, 185 MW, 39 and 22 m high weirs

Pakistan

- Gulpur HPP, 100 MW, 66 m high weir
- Karot HPP, 720 MW, 95 m high weir
- Kohala HPP, 1124 MW, 57 m high weir
- Patrind HPP, 147 MW, 26 m high weir

Nepal

*HPPs with fish ladder

- Upper Trishuli -1* HPP, 216 MW, 32 m high weir
- Kabeli A* HPP, 37.6 MW, 14.3 m high weir
- Khimti* HPP, 60 MW, 2.5 m high weir
- Andhi Khola* HPP, 9.4 MW, 8.3 m high weir

In Partnership with:



Creating Markets, Creating Opportunities

Bahrain

Dubai

Qatar

Migratory Fish species of special interest in Himalayas

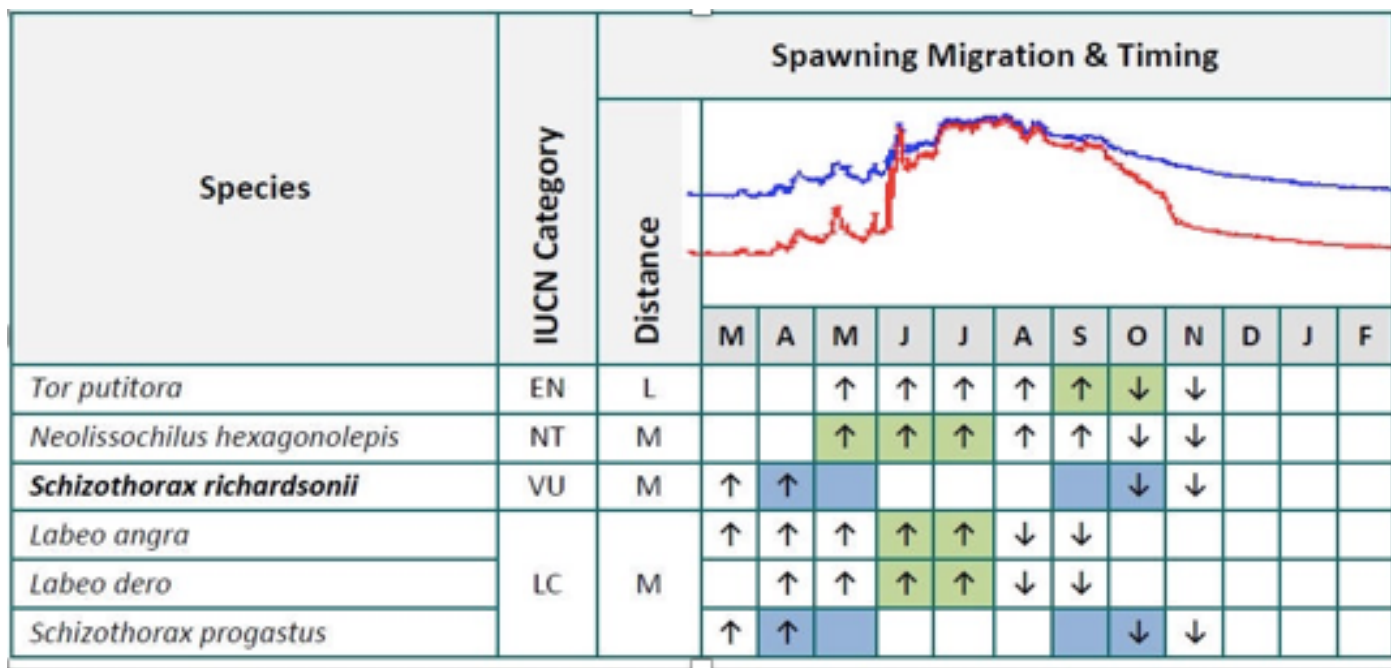


Tor putitora
(Cyprinidae)
Golden Mahaseer
Endangered (EN) on IUCN Red List



Schizothorax plagiostomus/richardsonii
(Cyprinidae)
Alwan Snow Trout
Vulnerable (VU) on IUCN Red List

Himalayan Fish Migration



Source: Ashok Baniya, NWEDC

Nepal

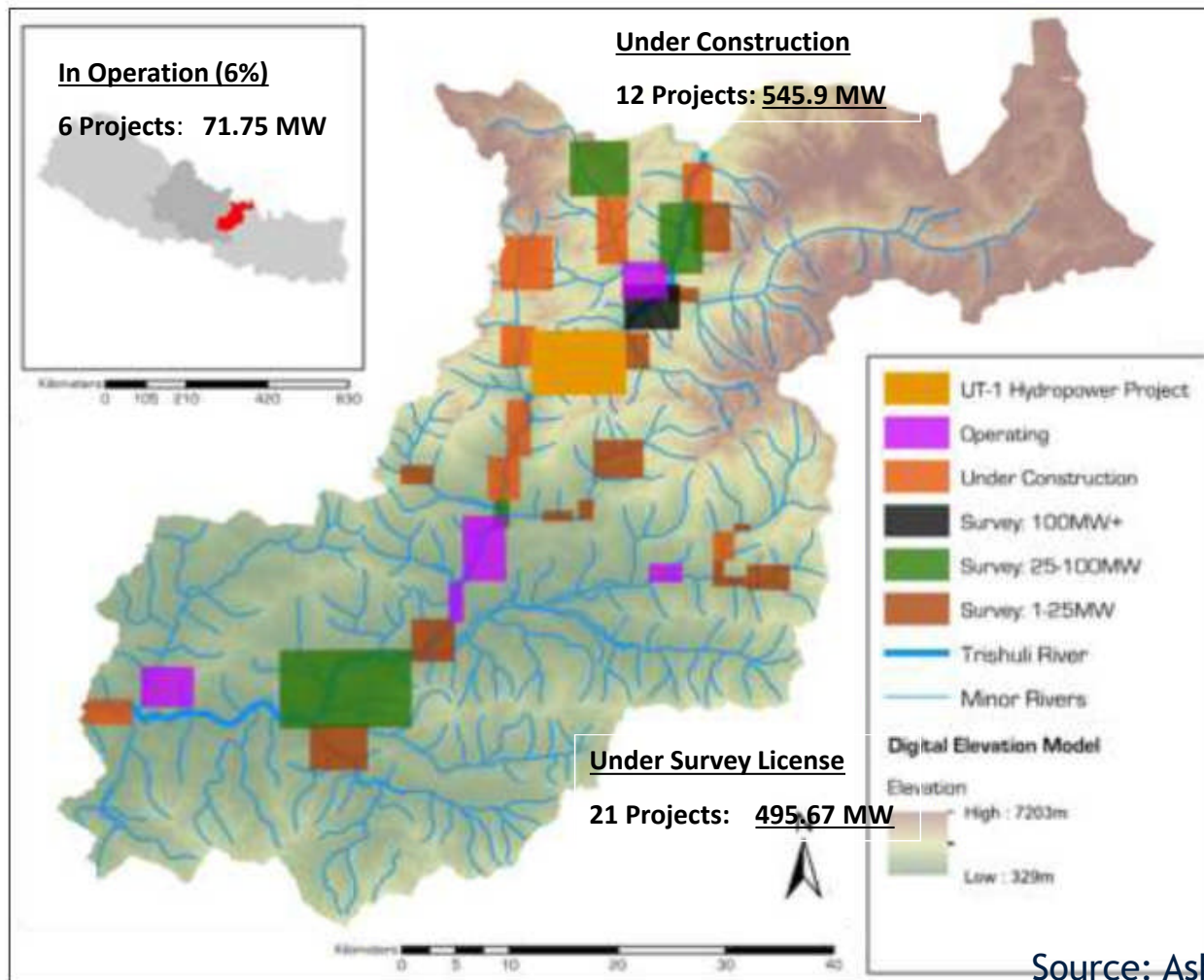
- National legal requirements to build a fish ladder or a hatchery
- Fish ladders typically built poorly and not monitored
- Thus general perception is that they do not work in Nepal
- No downstream fish passage requirement
- Khimti Khola HPP Nature-like fish passage is best example (60 MW, 2.5 m weir)



Source: Halvard Kaasa, SWECO

Nepal: Trishuli River HPPs

Cumulative impact :Trishuli River Watershed~1133 MW



Nepal: Upper Trishuli-1 HPP

Nepal Water and Energy
Development Company (NWEDC)

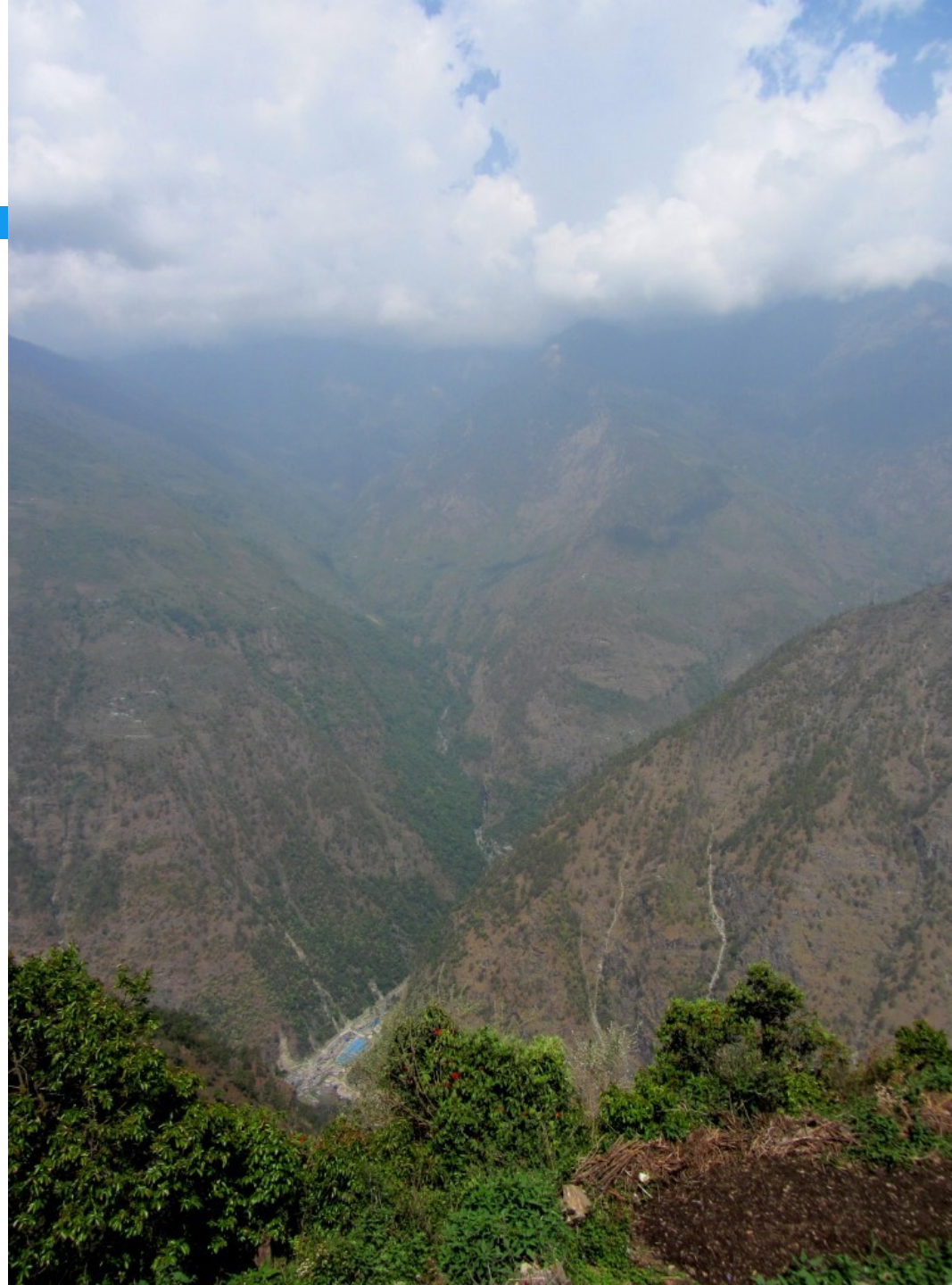
216 MW
32 m high dam

Upstream and downstream fish
Passage under design by
Halvard Kaasa, SWECO

For more details:
Ashok Baniya NWEDC
Presentation
Session B4
Tuesday 11:10 AM

2015

Photo: Leanne Farrell, World Bank



Nepal: Upper Trishuli-1 HPP



**2016
After
Earthquake**

Photo: Leanne Farrell, World Bank

Nepal: IFC Advisory Services

Series of Training workshops with USAID

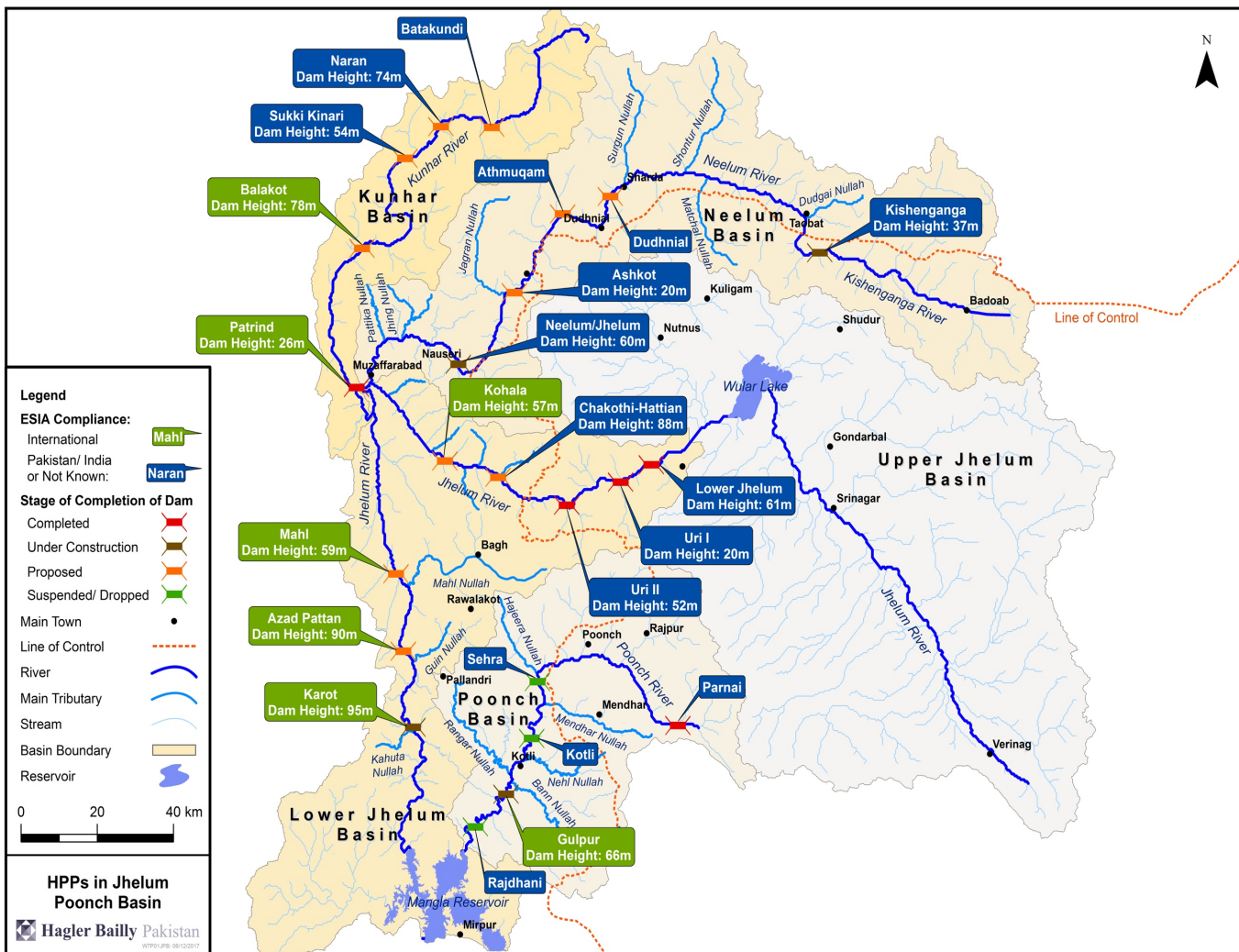
- Baseline freshwater data collection
- Fish Passage (with Dr. Brett Towler, USFWS)
- Environmental Flows
- Cumulative Impacts

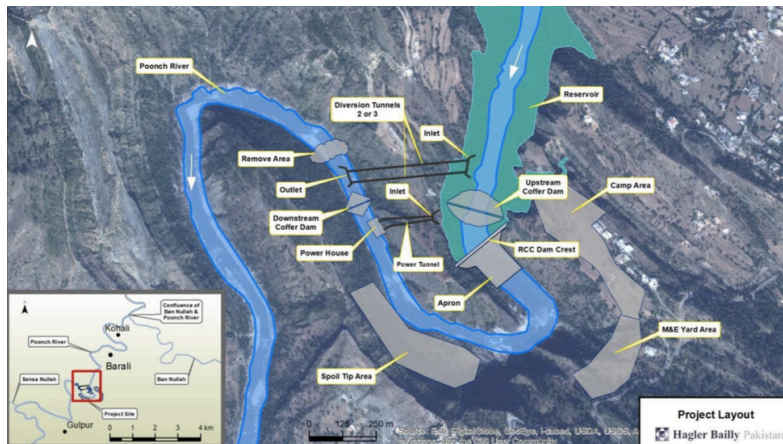
Trishuli River

Sustainable hydropower planning and development in the Trishuli River Basin based on a common, multi-stakeholder commitment to collaborative cumulative impact assessment, monitoring and co-management.

Pakistan: Jhelum-Poonch Basin, AJK

No Fish Passages





Biodiversity Action Plan (BAP)

- Ecological Flow Management Plan
- Mahaseer Hatchery
- Strong management plan and patrols for the Poonch River Mahaseer National Park
- Bans on non-selective fishing, fishing in tributary breeding grounds, and fishing during breeding season
- Limitations on and designated areas for sediment mining
- Protect tributaries for Mahaseer breeding

Pakistan: Basin Level planning

- Development of a coordinated Basin-wide Biodiversity Strategy for creating awareness and joining forces amongst diverse stakeholders, including all HPP developers, NGOs, and government agencies
- Strategically managing impacts and reducing risk of multiple HPPs on key biodiversity values across the Jhelum-Poonch River Basin
- Creation of Aquatic Biodiversity Offsets
- Environmental Flows management (Basin Wide DRIFT assessment)
- Institute for Research on River Ecology (*includes research on Fish Passage)
- Watershed Management Plan

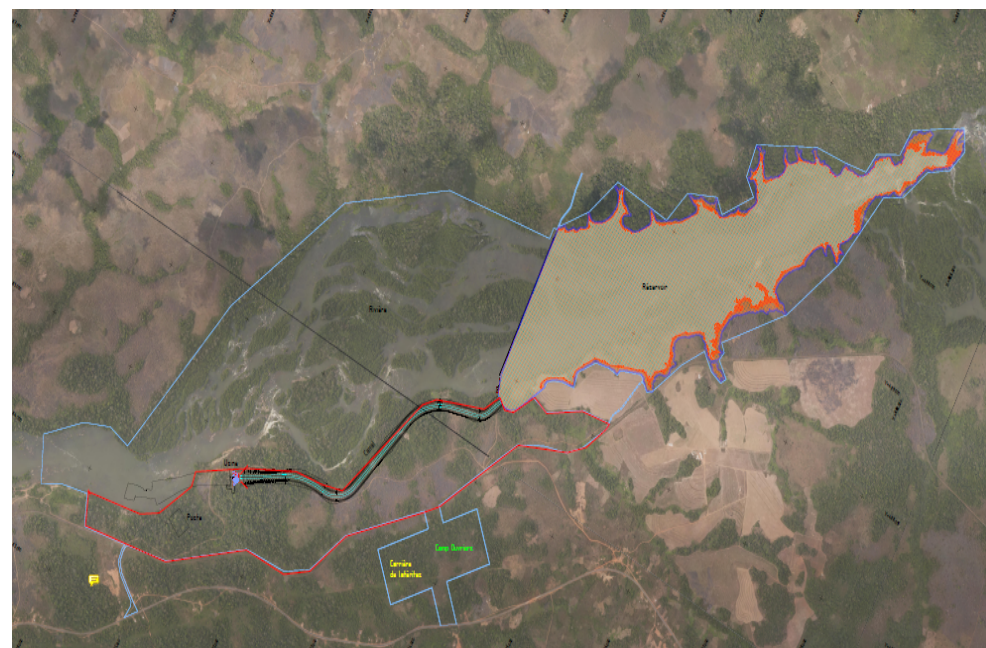
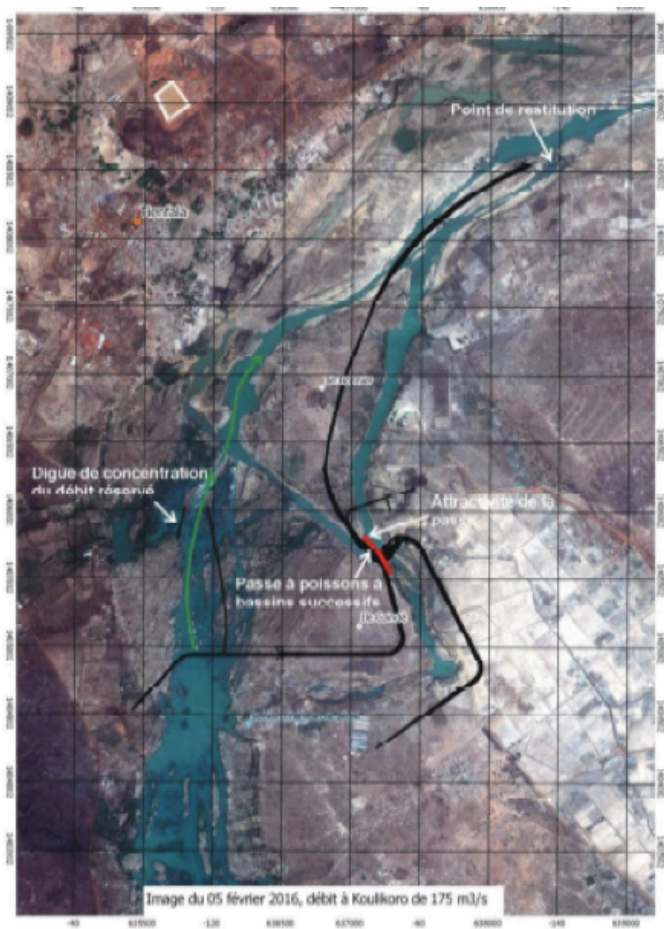
Mali and Cameroon (low weirs)

Niger River, Mali: 42 MW

12 m weir

60 species of migratory fish

Sanaga River, Cameroon: 420 MW, 15 m weir
~30 species of migratory fish, 9 Critical Habitat fish



Source: Artelia, EDF

Source: Artelia

Cameroon: Sanaga River

No fish ladder planned

Manual trapping and transport of fish located downstream of the dam upstream for migratory (30+) and Critical Habitat fish species (9).

Manual trapping will be done by electrofishing. This is currently being tested by Dr. Régis Vigouroux (Hydreco) and William Beaumont (Smith-Root).

After capture, the fish will be placed in aerated lagoons and transported upstream of the dam/reservoir into a habitat similar to that of the catchment area.



Labeobarbus mbami (Cyprinidae), EN



Chrysichthys longidorsalis (Clarotidae)

Republic of Congo

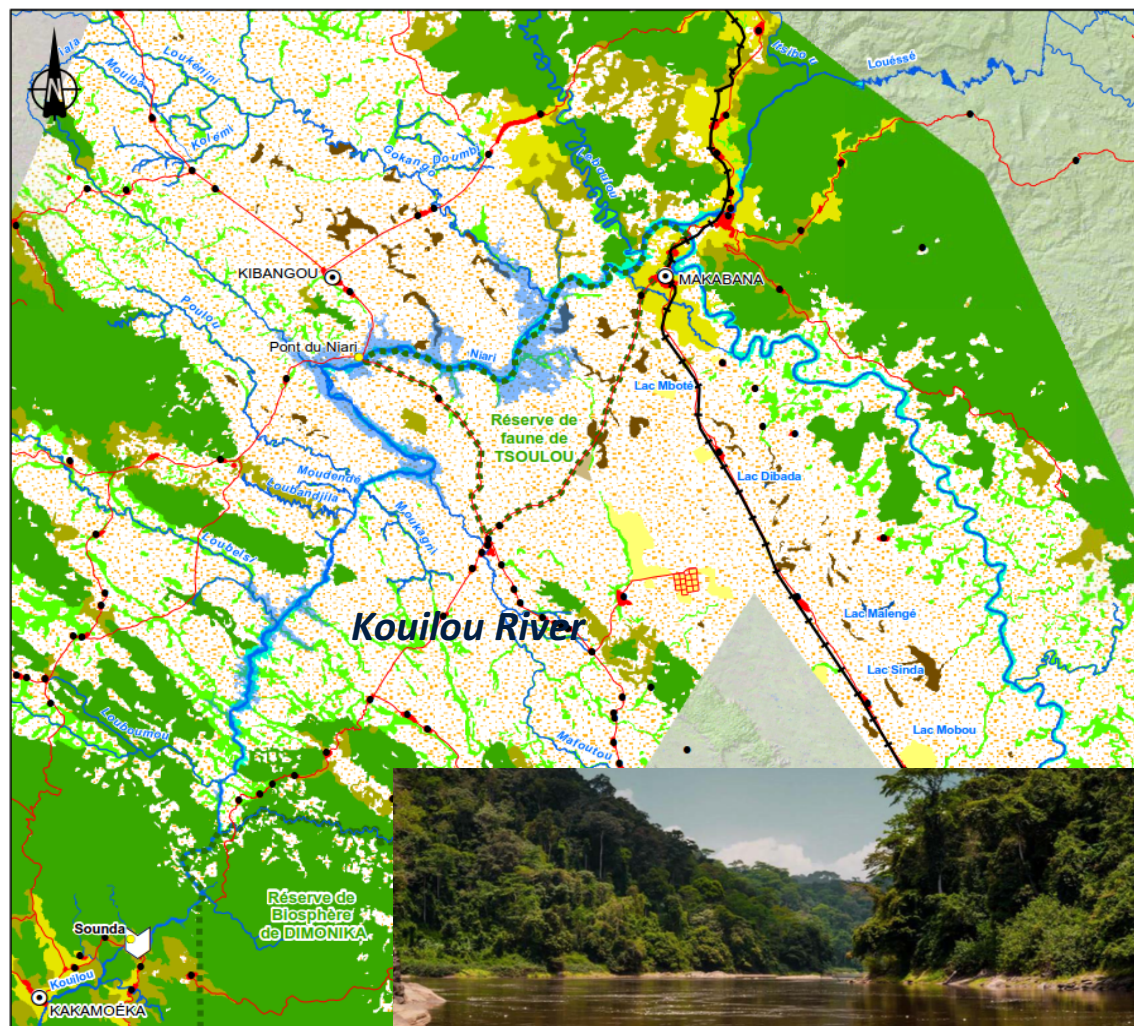
70 m high weir
Narrow gorge

Migratory fish species include:

- *Liza falcipinnis* (Mugilidae)
- *Elops lacerta* (Elopidae)
- *Polydactylus quadrifilis* (Polynemidae)
- *Pomadasys jubelini* (Haemulidae)
- *Pellonula leonensis* (Clupeidae)

Migratory shrimps:
Macrobrachium spp.

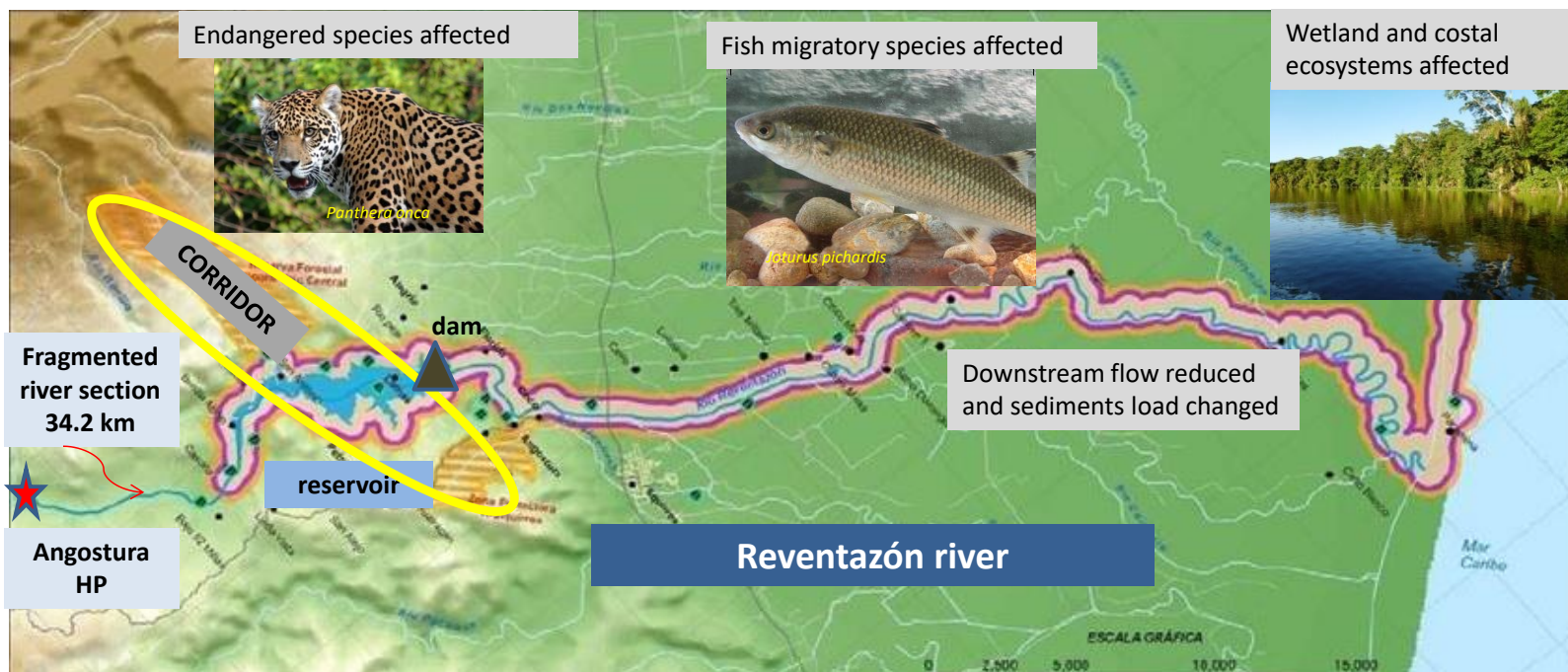
Fish Passage?



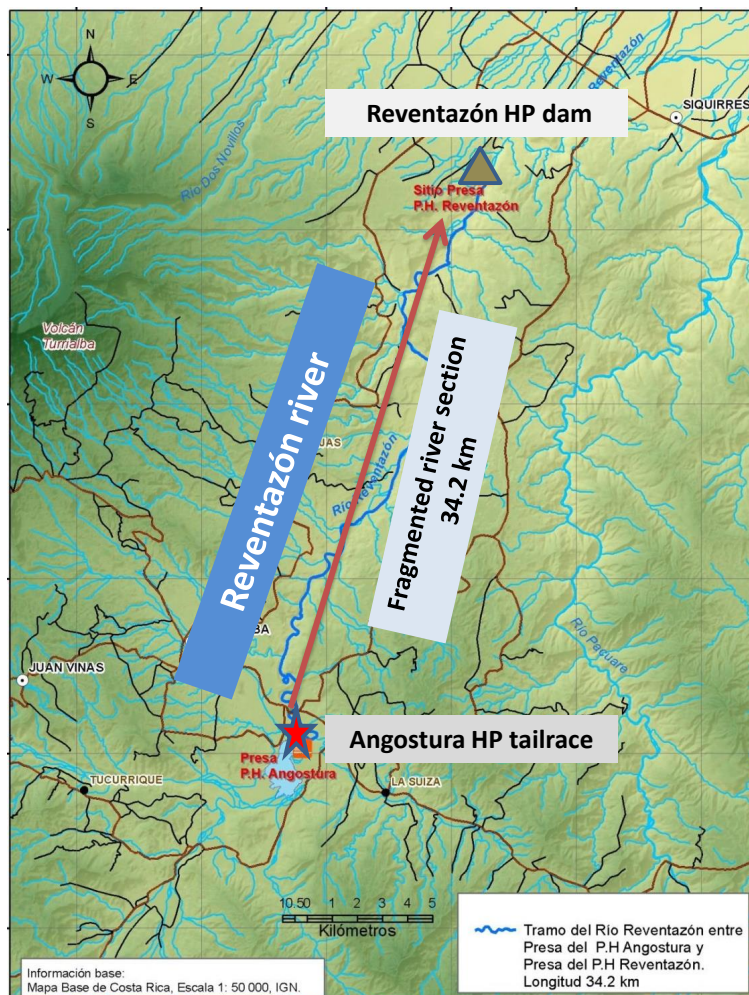
Source: AECOM

Cumulative/residual impacts caused by the RHP on key biodiversity habitats

- Loss of 8 km of flowing river because of the reservoir and fragmentation of other river sections.
- Fragmentation of the Barbilla-Destierro Jaguar Corridor
- Creation of a barrier (dam) for migratory species (fish, shrimp)
- Change in the hydrological regime and characteristics of the water quality



Costa Rica: Reventazon HPP (305 MW, 130 m high weir)



Aquatic Offset

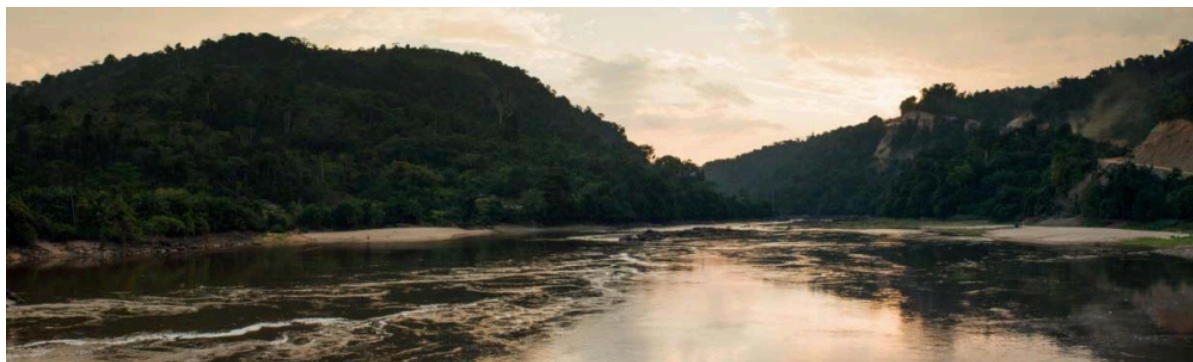
The Offset will compensate the Reventazon river connectivity loss – in term of length - from the Angostura HP tailrace until the Reventazon dam, which represents 34.2 km of the main river channel

Offset goals are:

- To conserve and protect a free-flowing river with similar natural features to the Reventazon river.
- To enhance quality of the aquatic and riparian habitats, and
- To achieve no net loss for connectivity and ideally positive gain.

Fish Passage Guidance Needs

- Evidence of successful fish passages, especially for high dams (>32 m).
- Information on types of fish passages best for high dams.
- Relative costs of fish passages, particularly in developing countries.
- Guidance on what is needed for effective trap and trucking and relative costs.
- Guidance on how to design fish passages for multiple tropical fish species.
- Protocols for evaluating success of fish passage.
- Protocols and technology for monitoring target fish species.
- Protocols and technology for monitoring fish migration and assessing species' ranges.



What is a HPP's motivation to include fish passage?

Fish Passage technology and implementation has evolved in the US Pacific Northwest due to the presence of the following (Michael Garello):

- Water Resources
- Intellectual Resources
- Public Support
- Cultural Integration (First Nations)
- Regulatory Framework
- Hydropower and Funding Resources

Developing countries lack many of these.

IFC's Performance Standards provide incentive but all the above need to be developed for environmentally sustainable hydropower to be possible.

Please visit the IFC booth for further discussion with:

Mr. Ashok Baniya, Environmental Manager,
Upper Trishuli-1 HPP,
Nepal Water and Energy Development Company, Nepal

Mr. Narayan Bijal, Executive Director,
S.A.N. Engineering Solutions Pvt. Ltd., Nepal

Mr. Salil Devkota, Environment Specialist,
Nepal Environmental and Scientific Services (NESS) P Ltd, Nepal

Mr. Ashwinikumar Ganpatrao Patil, Head- Hydro,
The Tata Power Company Limited, India

Mr. Vaqar Zakaria, Managing Director,
Hagler Bailly Pakistan, Pakistan

Contact Information

If you are interested, please give us your name so we can add you to our list of Consultants and Specialists who can help IFC clients review and/or design fish passages in developing countries.

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Visit:

www.ifc.org/hydroadvisory

www.ifc.org

Thank you!

